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Analysis of Technical Efficiency of Poultry Broiler Business with Pattern Closed House System in Malang East Java Indonesia

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Abstract

This study aims to determine the input variables affecting broiler production, the level of technical efficiency achieved breeders and sources of technical inefficiency causes. This research was conducted in Malang East Java Indonesia with a sample of 55 broiler breeder with a pattern closed house system (CHS).

The results showed that the variables affecting broiler production with patterns of closed house system is variable poultry (DOC), feed and medicine (drugs, vaccines and vitamins). The level of technical efficiency is achieved breeders ranged from 0.732 to 0.987 with an average of 0,929 broiler farms and businesses are located at the level of positive decreasing returns to scale. Variables business experience, number of dependents as the root cause of inefficiency.

Keywords: Broiler production, stochastic frontier, *closed house system*

1. Introduction

Livestock is one part of the agricultural sector needs to be developed and utilized optimally for the prosperity of the people. One potential developed farm commodities are broilers. This is due to produce broiler meat as a protein source that is very important for humans. The importance of the broiler meat causes an increase in population of broiler chickens in Indonesia. Based on the statistical data that in 2010 the population reached 1,115,108,029 thousand broilers tail / head or increased 5% when compared with the broiler population in 2009. Broiler meat production in 2010 amounted to 1.184.366.15 thousand tons, an increase of 2, 8% of total chicken meat production in the previous year. According to the Ministry of Agriculture in 2010 that national meat consumption reached 7.75 kg / capita / year. As many as 49 percent or as much as 3.80 kg / capita / year national meat consumption contributed by meat chicken. Indonesian population in 2010 reached 240 million. With the fourth largest population in the world, Indonesia is a huge market, it can be ascertained broiler meat demand will increase. Based on these data that the broiler farm has good prospects for development efforts.

In an effort to broiler farms, most farmers in Indonesia are already accustomed to using cage open house system. But this raises the cage system response is not good when the weather conditions do not support or weather changes drastically. Climate change (climate change) that is currently going on, directly or indirectly have an effect on the management of broiler breeders, especially using open cages (open house system). In extreme weather conditions, scorching heat and sudden rain or vice versa, making the temperature and humidity of the enclosure be changed drastically. If it is not treated properly can result in high mortality rates and declining production.

Maintenance broiler house using a closed system is one way to deal with technological innovation extreme weather changes, so it is expected to minimize the adverse effects of climate change in environmental conditions or outside the cage. The purpose of the use of the cage closed house system is to create a controlled microclimate inside the enclosure, improving productivity, efficiency and labor land and creating an environmentally friendly farm business. Closed house system development costs are expensive but broiler poultry farms with cage pattern are already running on some farmers in Malang East Java Indonesia.

The ability of broiler breeders with a pattern of closed house system in addressing environmental issues and resource allocation decisions are not the same. This is due to the diversity of the ability of farmers, potential diverse region, and different business environment. Differences will impact the ability of the farmer to the output generated by a combination of the use of a set of production as a combination. The combination of the use of production factors in any business that efficiently is an absolute requirement to make a profit. For it is necessary to study the factors that influence the production function and the achievement level of technical efficiency.

2. Material and Methods

2.1 Place and research data

This research was conducted in the District Pangelaran, District Dampit, and the District Bantur Malang East Java Indonesia. Selection of the study site on the basis that the area is a center of broiler chicken farming.

Determination of respondent is purposive (deliberately). Sampling was done by total sampling of 55 broiler breeder with pattern Closed House System.

2.2 Analytical techniques

Production function used in this study is the stochastic frontier production function of the Cobb-Douglas. The choice of the form taken by reason of the production function: Cobb-Douglas production function is homogeneous so that it can be used to derive a cost function from the production function (in accordance with the requirements of efficiency measurement limit) and Cobb-Douglas production function is simpler and rarely causes problems multikolinier. Aigner et al. (1997), Meeusen and Broeck (1997) and Coelli et al. (1998) explains that the production function equation is specified for the data cross (cross sectional data) the error term has two components, namely vi and ui.

Stochastic frontier production function Cobb-Douglas to be transformed into a linear form of the natural logarithm (Ln). The use of linear natural logarithm of this has advantages: scale juxtapose data so avoid heteroskedasticity and parameters or regression coefficients can be directly read as elasticity. Equation stochastic frontier production functions are as follows:

$$\ln (Y_i) = xi\beta + (vi - ui), \quad i = 1, 2, 3 \ldots N \quad \ldots\ldots 1$$

Stochastic frontier production function model is used to estimate the level of technical efficiency of farmers described mathematically as follows:

$$Yi^* = f(Xi; \beta) + \varepsilon i \quad i = 1,2,\ldots.n \quad \ldots\ldots 2$$

Where Yi* is output, Xi denotes the actual input variables, β is the parameter of the production function, which amount is not yet known, and ε is the error term that consists of two components, namely:

$$\varepsilon i = Vi - Ui \quad \ldots\ldots 3$$

The first error component Vi is the error tem is symmetric and assumed identical, independent and normally distributed N (0, σ2v). Ui is the error term that is independent of Vi and normally distributed N (0, σ2u). This allows the error term is below the actual production function frontier production function.

Technical efficiency in farming is defined as the condition of the actual output (Yi) on output Frontier (Yi *) by using the technology available. Thus technical efficiency equation becomes as follows:

$$\text{TEi} = \frac{\text{Yi}}{\text{Yi}*} + \frac{E\ (Yi/ui,Xi)}{E\ (Yi/ui=0,Xi)} = E\ [exp.(-Ui)/\varepsilon i] \quad \ldots\ldots 4$$

Value of technical efficiency (TE) is located in the intervening interval 0 to 1 or $0 \leq \text{TEi} \leq 1$. Technical efficiency value equal to 1 indicates that the broiler farm businesses in an efficient condition and if the technical efficiency value smaller than 1 means that the broiler poultry farms are inefficient and if the value of technical efficiency obtained by farmers is greater than 1 then broiler poultry farms are inefficient.

2.3 Model specification

Factors affecting broiler production in the closed house system (chs) are: poultry (DOC), feed, medicine, and electricity, and fuel, manpower. Cobb-Douglas functional form is mathematically formulated as follows:

$$LnY = \beta 0 + \beta 1LnX1+\beta 2\ LnX2+\beta 3\ LnX3+\beta 4\ LnX4 + \beta 5\ LnX5 + \beta 6\ LnX6+ Vi - Ui \ldots\ldots 5$$

Description:

Y = Production of broiler closed house system per period production (kg / pp)

X1 = Number of seedlings broilers (DOC) per production period (tail / pp)

X2 = amount of feed used per production period (kg / pp)

X3 = Number medicine used per production period (kg / pp)

X4 = Amount of electricity used per production period (kWh / pp)

X5 = Number of fuel used per production period (liters / pp)

X6 = Number of labor used per production period (persons / pp)

β0 = constant

β1-β6 = parameter input variables is not fixed suspected

Ln = Natural logarithm e = 2.718

Vi = Mistakes made due to a random

Ui = effect of technical efficiency appears

Technical inefficiency effects method used is based on the technical inefficiency effects model developed by Battese and Coelli (1998). Variable ui function to calculate the effect of technical inefficiency. Parameter value distribution of technical inefficiency in this study is as follows:

$$\mu_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 \quad \text{......} 6$$

Description:

μi = technical inefficiency effects

Z1 = Age of farmers (years)

Z2 = education level of farmers (years)

Z3 = farming experience (years)

Z4 = Number of dependents (people)

Z5 = Dummy sex

0 = Female

1 = Male

δ0 = constant

δ1-δ5 = parameter variables inefficiency

3. Results and Discussion

3.1 Analysis of Factors Affecting Production

Factors included in the stochastic frontier production function model and alleged effect on the level of broiler production is poultry (DOC), feed, medicine, electricity, fuel, and labor. The results of the analysis of Maximum Likelihood Estimation (MLE) are shown in Table 1:

Based on the analysis in Table 1 it is known that there are 2 inputs and 1 very significant effect on the level of significant input $\alpha = 0.05$ and 3 inputs have no effect on broiler production. Inputs affecting broiler production at the level of $\alpha = 0.01$ is variable seed broilers (DOC) and feed, while the variables that affect the $\alpha = 0.05$ is medicine (drugs, vaccines, and vitamins). Influential variable indicates that if the input is increased then the broiler production will also increase with the assumption of ceteris paribus. Thus the implication that if the seeds of broilers increased by 10 percent would increase production by 5.66344 percent and if the variable is added feed by 10 percent will boost broiler production by 4.64372 percent and the expected increase in broiler production by 0.24813 percent of 10 percent when added variables medicine (drugs, vaccines, and vitamins). Variables that do not affect the production of broilers is variable electricity, fuel and labor. The coefficient of electrical variables in the production function limits obtained a value of 0.110388 and has a positive relationship but broiler farming pattern closed house system. Positive relationship obtained prove that in the broiler chicken farm power assist broiler to eat and drink in the evening, although not significantly influence the results of production. Similarly, that with the addition of a number of fuel and labor will not cause additional broiler production.

Table 1. Results of Stochastic Frontier Production Function Analysis Method with Maximum Likelihood Estimation (MLE) on breeder Closed House System (CHS)

Variables	MLE		
	Koefisien	std-error	t-ratio
Constants	-0,64425	1,10704	-0,58196tn
Poultry (X1)	0,566344	0,12737	4,44652***
Woof (X2)	0,464372	0,11244	4,12993***
Medicine (X3)	0,024813	0,0156	1,59087**
Electricity (X4)	0,110388	0,15993	0,69021tn
Fuel (X5)	-0,07319	0,2883	-0,25385tn
Labor (X6)	-0,06109	0,05677	-1,07605tn
Sigma-squared ($\sigma s^2 = \sigma v^2 + \sigma u^2$)	0,063	0,152	0,413
Gamma ($\gamma = \sigma u^2 / \sigma s^2$)	0,984	0,033	29,545
Log Likelihood			66,672
LR Test			10,368

Description:

** = Significant at α = 0.05 level
*** = Significant at α = 0:01
tn = no effect

Value Return to Scale (RTS) is obtained by summing the coefficients of the variables included in the model. Based on the analysis results obtained RTS value of 1.03164. This value indicates that broiler production with patterns of closed house system is at stage II (positive decreasing returns to scale), which means that if all the inputs together plus 10 percent of the broiler production will increase by 10.3164 percent.

3.2 Technical Efficiency Analysis

Value of gamma (γ) obtained in broiler farms with closed house system is a pattern of 0.984 and was highly significant at α = 0.01 confidence level. Acquisition value indicates that the variation is due to confounding errors of technical efficiency was 98.4 percent, or the difference between actual production with the possibility of a maximum of 98.4 percent of production due to differences in technical efficiency and by 1.6 per cent due to variables outside the control or measurement error. Value of gamma (γ) which is almost close to 1 in the group of breeders of the closed house system error indicating that one side (one-sided error) ui dominates the symmetric error distribution of vi. It is also supported by the value of the LR test of the one-sided error obtained on the pattern of broiler breeder closed house system very real. LR test values obtained with the pattern of broiler farms closed house system is at 66.672 and the value of the LR test is much greater than the value of $\chi 2$ = 3.84146. This shows that almost all of the variation in the output of the production frontier can be considered as a result of the level of achievement of technical efficiency related to managerial issues in the management of broiler poultry farms

Value of technical efficiency in the range of 0.732 to 0.987 with an average of 0,929. Figure 1 shows the range of technical efficiency achieved by broiler breeder with a pattern of closed house system.

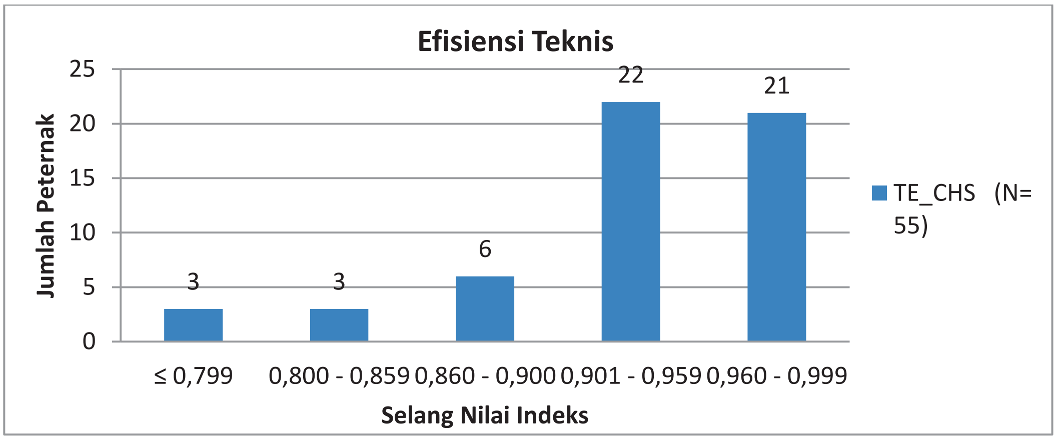

Figure 1. Distribution of Technical Efficiency in Broiler Breeder with Pattern Closed House System

Based on the results described above that the technical efficiency levels achieved by individual broiler breeder with a pattern of closed house system are diverse. The diversity of achievement of technical efficiency level per individual farmer is caused by differences in managerial ability, especially in the set, formulate and use the factors of production to produce a number of products. If the average farmer can achieve the highest efficiency level as its competitors breeders who can achieve the highest efficiency, then the average farmer can save costs by 5.88 percent (1 - [0.929 / 0.987] x100). The same thing also happened on the technical efficiency of farmers is low. If farmers can achieve the highest efficiency so they can save as much as 25.84 percent (1 - [0.732 / 0.987] x100).

3.3 Analysis of the sources of inefficiency causes

Analysis of the sources of inefficiency causes

The level of technical efficiency achieved by perindividu broiler breeder with a pattern of closed house system is diverse. The diversity of achievement of technical efficiency index is caused by differences in the determinant factors that are owned by each farmer. Determinant factors are socioeconomic factors breeders and these factors indirectly affect the production of broilers. These factors include, among others, breeder age, level of formal education, business experience, number of dependents and gender dummy variables. The results of the analysis are shown in Table 2 below:

Table 2. Results of analysis of the sources of inefficiency causes technical

Breeders group Closed House System (CHS)				
Variabel	Parameter	Alleged Value	Std Error	T-Ratio
constants	δ_0	-1.5089	3.98449	-0.378694
age (Z1)	δ_1	-0.01185	0.0375	-0.316065
education (Z2)	δ_2	0.13376	0.30596	0.437181
Business experience (Z3)	δ_3	-0.06217	0.18987	-0.327453
Number of Dependent Family (Z4)	δ_4	-0.10636	0.28988	-0.366925
***Dummy Sex* (Z5)**	δ_5	0.0797	0.31511	0.252923

Description:
tn = no effect

Estimate of the effect of technical inefficiency Stochastic Frontier production functions in broiler breeding business with the pattern of closed house system showed that all determinant variables included in the model were not statistically significant, however, some of the variables included in the model of technical inefficiency has a positive direction and there Similarly variable is negative. The variables found positive direction among others is the level of formal education (z2) and the gender dummy variable (z5). These findings suggest that the higher the level of formal education of farmers will increase also the technical inefficiency or negative effect on technical efficiency and breeder male sex was not shown to reduce technical inefficiency. This is thought to be due in broiler breeding business with the pattern of closed house system using equipment enclosure that can be operated by the sex of men and women. The variable that is positive indicates that these factors have contributed in improving the technical inefficiency.

Factors negatively respondents aged farmer and did not significantly affect technical inefficiency effects broiler breeding business with the pattern of closed house system. These results are not in accordance with the initial hypothesis where age factors included in the model of technical inefficiency with the notion of a positive effect that the increasing age of farmers will increase inefficiency. The invention is different from the initial guess is allegedly caused by equipment closed house system that can be operated by a wide range of age, or in other words in a broiler farm business management with a pattern of closed house system does not require a lot of physical ability breeder. Results of the present invention similar to that done by Kabede (2001) and Todsadee A et al, (2012) that age is negatively related to technical inefficiency determinant variables are negative. Farming experience factor is not significant with a negative relationship to technical inefficiency. These findings together with an initial guess that with more experience in broiler farming with the pattern of closed house system will improve the technical efficiency or lower technical inefficiency. The obtained negative sign indicates that the longer the time spent in trying broiler breeders with closed house pattern will be able to enhance everything related to farm business management in order to increase the production of broilers. The same findings by EJ Udoh and Etim N. A (2009), Jonah R (2009), Ismunandar D (2012), C. I Ezeh, CO Chukwu Anyiro and J. A (2012) who found that the experience factor positively correlated with technical efficiency. Variable number of family dependents broiler breeder with a pattern of closed house system has a negative correlation with technical inefficiency. The negative relationship indicates that the greater number of dependents will be able to reduce the level of technical inefficiency because the role of family members in the cattle business is expected to improve productivity. Average dependents breeders closed house system in the study area are as much as 3.4 person spread of 3 to 5 people. The results of the study by C. I Ezeh, CO Anyiro and J. A Chukwu (2012) found that the number of family dependents to be positively correlated with technical efficiency.

4. Conclusions and Recommendations

a. Variables affecting broiler production with closed house system is a pattern of poultry (DOC), feed and medicine (drugs, vaccines and vitamins).

b. Value of technical efficiency achieved by broiler breeder with a pattern of closed house system in the range of 0.732 to 0.987 with an average of 0,929

c. Determinant variables that can positively influence the technical inefficiency is the business experience and the number of family dependents while the variable age, gender and education level age proved no negative effect.

Based on the results of the analysis can be recommended that the frequency of mentoring from both government and private sector in livestock farming activities.

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